SAMPLING OF AMBIENT AIRBORNE TRITIUM

Purpose

This Meteorology and Air Quality Group (MAQ) procedure describes the field sampling of water from the air, the distillation process, and the submission of a sample for analysis for the presence of tritium.

Scope

This procedure applies to the collection and preparation of the silica gel tubes used to collect atmospheric moisture (containing tritium) as part of the AIRNET monitoring system.

In this Procedure

Hazard Control Plan

The hazard evaluation associated with this work is documented in Attachment 1: Initial risk = **medium**. Residual risk = **low**. Work permits required: none. First authorization review date is one year from group leader signature below; subsequent authorizations are on file in group office.

Signatures *(continued on next page)*

Prepared by: Alice Baumann, MAQ	Date: 8/20/02
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General information about this procedure

Signatures, *continued*

Approved by:	Date:
Terry Morgan, QA Officer	8/30/02

Attachments

Number	Attachment Title	Pages
1	Hazard Control Plan	2
2	Figure Showing Distillation Equipment Setup	1

History of revision

Revision	Date	Description of Changes
0	7/19/94	New document issued as LANL-ESH-8-204.
1	12/18/95	Revised to reflect changes in process and organization.
2	5/15/96	Added electronic recording of field data; changed the tracking of sample period by color of cartridge head.
3	9/24/96	Expanded steps for inoperative pumps, added attachment for example of electronic data recording, added actions for station 90, added field safety information to prerequisites.
4	2/20/97	Add steps and time limits for submitting records when completed, other editorial changes.
5	6/9/98	Added balance check sheet, added steps for recording balance checks, revised steps for submitting samples for analyses.
6	2/26/99	Revised steps for describing weighing of cartridges and recording data, changed attachments.
7	4/21/00	Added HCP as Attachment 1, described use of BalanceLink program, revised steps describing use of queries for entering distillate data, added chapter for handling matrix spikes, removed attachment "Example of Electronic Silica Gel Mass Data Entry," and made minor editorial changes.
8	9/7/00	Revised to allow processing of silica gel by either on-site distillation or shipment to off-site lab.
9	3/13/01	Added steps for new trip blanks, changed process for processing and packaging spikes and trip blanks, removed form for balance checks.
10	4/15/02	Revised to reflect use of Palm computer devices, revised some steps about sample handling, and revised handling of station 90 filters.
11	8/30/02	Add new steps for adding water to trip blanks after initial weights and to weigh trip blanks with other samples.

General information, continued

Who requires training to this procedure

The following personnel require training before implementing this procedure:

- MAQ personnel assigned to collect and/or process AIRNET samples

Training method

The training method for this procedure is **on-the-job** training conducted by a previously trained individual and is documented in accordance with the procedure for training (MAQ-024).

Prerequisites

In addition to training to this procedure, the following training is also required prior to performing this procedure:

- CPR and First Aid
- Radiation Worker I training
- MAQ-202, "Environmental Sampling of Airborne Particulate Radionuclides"
- MAQ-216, "Management of AIRNET Field Data"
- ESH-13 training "Hazard Communication Introduction" (course # 2398)
- TA-54 Area G site-specific training
- TA-15 site-specific training

Periodically review the field safety information in the New Employee Handbook (see MAQ-032).

Definitions specific to this procedure

Tritium: ^{3}H an isotope of hydrogen, a beta emitter with a half life of 12.3 years.

Silica gel: A drying agent that absorbs water vapor from the air. It has the chemical name "silica acid."

References

The following documents are referenced in this procedure:

- MAQ-024, "Personnel Training"
- MAQ-026, "Deficiency Reporting and Correcting"
- MAQ-032, "Orienting New Employees"
- MAQ-202, "Environmental Sampling of Airborne Radionuclides"
- MAQ-205, "Calibration of Air Sampling Stations"
- MAQ-216, "Management of AIRNET Field Data"
- MAQ-AIRNET, "Sampling and Analysis Plan for the Radiological Air Sampling Network (AIRNET)"

Process description

Background

Los Alamos National Laboratory routinely handles tritium as part of its operations. As part of the Air Quality Group's AIRNET system, the Air Quality Group (MAQ) monitors levels of ambient tritium. The air monitoring network (AIRNET) samplers continuously collect water vapor from the atmosphere that is analyzed to determine airborne tritium concentrations. See the AIRNET QA Project Plan (MAQ-AIRNET) for a detailed description of the project purpose and requirements.

Water vapor is collected by silica gel in a plastic tube. A pump continuously pulls air through the silica gel cartridge. Cartridges are collected every two weeks.

What is tritium?

Tritium is an isotope of hydrogen. Tritium gas can occur as T_2 or HT. Tritium oxide is usually in the form of HTO, but T_2O can also occur. In the environment, tritium gas will eventually oxidize into tritiated water vapor. Sampling of tritium oxide is addressed in this procedure.

Sources of tritium

The Laboratory handles tritium as part of some of its operations and periodically releases small amounts of tritium to the environment. In addition, there have been some unplanned releases to the environment of elemental tritium gas and tritiated water vapor.

There are four primary sources of tritium sampled by this method:

- natural tritium produced by the interaction of cosmic rays with hydrogen atoms in the atmosphere
- tritium produced by atmospheric nuclear testing
- tritium released from Laboratory operations and other operations
- tritium from commercial products such as exit signs and illuminated markers

Worker safety

Performing work safely

DO NOT perform work under conditions you consider unsafe. Before beginning work described in this procedure, review safety needs and requirements, identify hazards, and develop hazard mitigation measures. Be aware that facility configurations and hazards may change between visits.

Stormy weather – Reschedule or delay work activities as necessary to avoid areas experiencing severe or dangerous weather.

Fall protection equipment must be used if the performance of work on a sampler requires personnel to work **within 6 feet of the edge of a 6 foot or greater drop.**

Electrical equipment - Work described in this procedure is performed in close proximity to energized equipment. Do not work in the vicinity of exposed conductors. If electrical conduit at a station is damaged, do not touch the station – instead, call JCNNM and request repairs.

Preparation of silica gel cartridges

Sample changeout and processing schedule

Air filters (see MAQ-202) and tritium cartridges are generally changed every two weeks (up to three for some holidays) but may be changed sooner for special situations as directed by group or project managers. Preparation of sample cartridges (this chapter) is performed early in the week preceding "changeout" week. Sample changeout generally takes three days.

Drying silica gel

To remove initial moisture from the silica gel, dry the silica gel, in a tray or in the original metal cans with the lid removed, in a drying oven between 105°C and 150°C for at least 2 days ~~5 hours (overnight is okay)~~. Remove the hot cans with the orange terry cloth gloves. Replace the lids tightly immediately after removal from oven.

Equipment needed

At the "Cave" at TA-54-1001, collect the materials and tools listed below. If needed, obtain additional silica gel from the contract chemical supply warehouse.

- fresh silica gel, 6-12 mesh
- balance, 1000 g capacity (minimum)
- plastic funnel
- empty silica gel cartridges for all sample locations, including five "blank" cartridges (87, 88, 89, 98 and 99, to serve as trip blanks); all cartridges should be the same color to identify the sample week

NOTE: Cartridges are labeled and dedicated for reuse at a single location.

Filling the cartridges

Make sure all the material and equipment that will contact the silica gel are clean and dry before proceeding. To fill the cartridges, perform the following steps:

Step	Action
1	In the laboratory, zero the balance. Before weighing cartridges for the day, use the 500g and the 1kg check weights to check the balance function. Put on cloth gloves or use special plastic-tipped tweezers to handle the weights. Note the results on the appropriate Access query. Ensure the balance reads zero with no weights but WITH any supports to be used (see step 5).
2	Ensure all cartridges have the same color for that week, to identify the sampling week to which these cartridges belong.

Steps continued on next page.

Preparation of silica gel cartridges, continued

Step	Action
3	Turn on the hood. In the hood, fill all the sampling cartridges to the top with dry silica gel. Each cartridge will hold about 135 g of silica gel. Replace the top.
4	If not already running on the PC, launch the Mettler Toledo BalanceLink program and minimize it to an icon.
5	Place a cartridge on the center of the balance pan so that the fittings do not touch the table or the sides of the balance (you may use a support if appropriate). Press F2 to transfer the weight from the balance into the selected cell of a displayed table or query. Repeat to weigh all cartridges.
6	Print out the just-recorded weight data and re-weigh all the cartridges. Compare the weights with the printout data to verify proper data entry and initial and date. File this record as described in the chapter *Records Resulting*.
7	Add 10 g of deep well water to the trip blanks.
8	Take the trip blanks with the cartridges during changeout and collection; between collections, store the cartridges in the lab. Ensure these cartridges are processed (in about 24 days) with the cartridges just prepared, not with the samples to be collected the next week. Maintain proper chain-of-custody on these samples (see chapter *Chain-of-custody for samples*).

If network connection to AIRNET is down

If the connection to the AIRNET database does not operate for some reason and the data cannot be loaded directly into the database, follow the steps for obtaining initial (above) or final (page 12) weights, EXCEPT load the Excel spreadsheet **d:\GelWeights\GelWeightsTemplate.xls** from the local computer hard drive and enter the data into this instead of the AIRNET database. Follow the instructions in the user's guide to enter the weight data.

After data entry into the spreadsheet, save the file and give it a name (e.g., "Final020318" or "Initial020318", where "Final" is for final gel weights and "Initial" is for initial gel weights; "020318" is the period ID). Send the file (via e-mail if available or on a diskette to take to the group office) to the AIRNET database manager for loading into the AIRNET database.

Field changeout

Working alone policy

The group prefers two people to travel together to collect AIRNET samples. However, it is acceptable for one person to collect samples. In either case, ensure you have a working cellular phone or radio in the vehicle.

Working in a facility

Work control in a laboratory facility is the responsibility of the Facility Manager. Routine sample collection and pump maintenance activities do not require facility management approval before beginning work described in this procedure; contact the facility manager before any other work. Complete all facility-specific training requirements (see prerequisite training requirements on page 3) and follow any facility-specific work rules.

Working at pueblos

Work control is the responsibility of the pueblo authorities. Complete the following check-in requirements:

- Jemez check in before doing any type of work
- San Ildefonso check in before doing any type of work

Arrangements with some pueblos provide for them to collect their own samples and deliver them to the field team for inclusion in the current sample shipment. AIRNET personnel may occasionally collect the samples at the pueblos.

Working on private property

Each private property owner has a separate arrangement with the group. Check with the project leaders for any special requirements.

Caution at damaged stations

When approaching a station, if the AIRNET station housing appears damaged in such a way that electrical wires are exposed or could be shorted to the housing or conduit, **do not touch the station**! Immediately report the damage and request that JCNNM repair the electrical damage.

Changing the sampler heads

Consult the attachment to MAQ-202 for the locations and directions to the AIRNET sample locations. Travel to each sampler location and perform the following steps at each station.
Note: Two people may perform the following steps, in which case the recording of the data (step 6) may be done by the second person and the timer may be reset (step 7) as soon as the data are recorded.

Field changeout, continued

Step	Action
1	Open the housing and read the timer. If both timer and pump are operating properly, skip to step 4. If the timer is inoperative and the pump <u>is</u> running, estimate the timer reading by either calculating the hours since the previous sample change, or use a timer reading from a station known to have run for the same period.
2	If the pump is <u>not</u> running, attempt to restart it by resetting the GFCI breaker and then checking the power source breaker, or taking other actions. In the case of no power to a pump, use a pointed object (pen, stick, etc.) to press the "TEST" and then the "RESET" buttons on the GFCI box. If there is still no power, check the main power breaker if you can determine where it is. If it is tripped, confirm that no electrical work is in progress, and, if safe to do so, reset it. If these actions fail or cannot be completed, contact the facility manager or the JCNNM Coordinator. At pueblo sites, notify the appropriate pueblo contact. If the pump is started, skip to step 4. If the pump cannot be started, continue with step 3.
3	Read the as-found flow rate for the silica gel. If, for some reason, a flow reading cannot be obtained when the pump is running, record a final flow rate of 0. If the flow meter indicates more than 250 cc/min, use the Buck calibrator (see MAQ-205) to obtain a reading. Record in the comments field that the Buck calibrator was used to obtain the reading.
4	Change the sample: • Remove the used cartridge from the quick-connect fitting. • Remove the blue plugs from the new cartridge and place on the used cartridge. • Install the new cartridge on the quick-connect fitting. Make sure the label on the cartridge correctly matches the location and the color on the cartridge is correct for the sample period.
5	Set the flow rate to 200 cc/min (±20 cc/min) after the new cartridge is installed.

Steps continued on next page.

Field changeout, continued

Step	Action
6	Record the following data either on a form (e.g., "Air Monitoring Field Data Form and Chain of Custody Record" [Attachment 1 to MAQ-202]) or electronically (in accordance with MAQ-216): • date and time (recorded automatically by the field computer) • timer reading (hours) • initial (as-found) air flow rate • final (after new filter and cartridge installed) air flow rate • sample I.D., in the following format: a sample collected the week of February 14, 2000 (always a Monday) at station 13 would be 000214.13. Label the trip blanks as "station" numbers 87, 88, 89, 98, and 99 (recorded automatically by the field computer). • any comments on difficulties encountered, "unusable" sample, estimated data, or other conditions
7	Reset the digital timer by pressing the reset button.
8	The flow rate is pre-set to 180- 220 cc/min during the pump calibration procedure (MAQ-205). If the flow rate is outside these limits, adjust the flow using the knob on the meter.
9	Close and secure the sample housing.
10	Follow the requirements in the chapter *Chain-of-custody for samples* for chain-of-custody documentation and handling.

If sampler is inoperable or damaged

If a sampler is found in an inoperable condition, or if there are other problems that have resulted in a total or partial loss of sampled material or affected the integrity or reliability of the sample, the condition must be documented by recording the condition in the field notebook or palmtop computer logbook. Record in the comments whether a datum was estimated (e.g., enter "Estimated timer reading" in comments if timer was out and hours were calculated from other sampler information).

If the condition is simply a power-out condition caused by a breaker, document the condition by recording in the field notebook or field computer.

If the condition cannot be easily corrected at the site, also (in addition to the step above) initiate a deficiency report according to the deficiency procedure (MAQ-026).

If the problem is an inoperable pump, also request a pump change in accordance with the procedure for pump calibration (MAQ-205).

Field changeout, continued

Chain-of-custody documentation

After returning to the "Cave",

- make a copy of the chain-of-custody form (if data were recorded on paper)

or

- download the data from the field computers (if data were recorded electronically) to the desktop computer database and print the tritium c-of-c forms according to MAQ-216.

Check the data on the forms for errors and keep them in a safe place until samples are shipped. See chapter *Chain-of-custody for samples*.

Processing the silica gel

When to process the silica gel

After returning to the laboratory, prepare the silica gel as soon as reasonably possible (no later than 21 days after collection) so the cartridges will not absorb additional moisture. If the network connection to the Access database is down, see the instructions in "If network connection to AIRNET is down" on page 7.

Steps to weigh the silica gel

To weigh the samples, perform the following steps:

Step	Action
1	Before weighing cartridges for the day, use the 500g and the 1kg check weights to check the balance function. Put on cloth gloves or use special plastic-tipped tweezers to handle the weights. Note the results on the appropriate Access query. Ensure the balance reads zero with no weights.
2	If not already running, launch the Mettler Toledo BalanceLink program and minimize it to an icon.
3	Be sure both blue caps are located in the end pieces of the cartridge. Place the cartridge on the center of the balance pan so that the fittings do not touch the table or the sides of the balance (you may use a support if appropriate). Use the appropriate MS Access "AIRNET" database table or query; press F2 to transfer the weight from the balance into the database. Repeat for each cartridge.
4	Print out the just-recorded weight data and re-weigh all the cartridges. Compare the weights with the printout data to verify proper data entry and initial and date. File this record as described in the chapter *Records resulting from this procedure*.
5	Prepare a computer disk containing the water content data for the analytical laboratory according to the instructions on the AIRNET database for "AIRNET Field Data Water Collection EDD."

Determine how to process the silica gel

Contact the project leader or the analytical chemist to determine if the silica gel is to be distilled on-site or shipped to an external laboratory. Follow the steps below if the silica gel is to be shipped for distillation by an external laboratory; follow the second set of steps if the silica gel will be distilled at the MAQ facilities at LANL. Then continue with the following chapter *Submitting water samples for analysis*.

Processing the silica gel, continued

Materials needed for shipping silica gel

Collect the following equipment and supplies from storage area at TA-54-1001:

- 250 ml polyethylene bottles (from Fisher)
- 12 x 12 x 6 heavy duty box (from shipping at TA-3 SM-31)
- security tape
- permanent marker
- strapping tape
- pre-printed labels with sample numbers (from AIRNET database)

Steps to unload cartridges

To unload the silica gel cartridges, perform the following steps:

Step	Action
1	Pre-label all the bottles by writing the station number on the bottle (not the cap) with a marker.
2	Put the pre-printed labels on the bottle.
3	In the laboratory hood, line up as many bottles with their respective cartridges as will easily fit in the hood.
4	Unscrew the tops from the cartridges and pour the silica gel into the appropriate pre-labeled bottle.
5	Before removing the cartridges and bottles from the hood, double-check that the cartridge and bottle numbers match and that there were no errors in labeling.
6	Repeat steps 2 through 4 for the remaining cartridges.
7	Take 3 previously labeled spiked samples and 3 previously labeled blank samples (in plastic shipping containers) from the cabinet.
8	Package all the bottles and the computer disk of water content data in the box. Use bubble wrap to pad the shipment. Use custody tape in appropriate places so it would indicate tampering.
9	Continue with the chapter *Submitting water samples for analysis*.

Processing the silica gel, continued

Distilling the silica gel samples

Follow the steps below if the silica gel is to be distilled at the MAQ facilities at LANL.

After returning to the laboratory, distill the samples in the week after collection or as soon as reasonably possible (no later than 21 days after collection) so they will not absorb additional moisture.

Up to 21 samples can be distilled at one time. Distill the samples according to which AIRNET group they belong. Example: Run Area G samples together. The field trip blanks are usually distilled with the regional stations.

Materials needed

Collect the following equipment and supplies from storage area at TA-54-1001:

- sample scintillation vials, 20 cc (Fisher # 03-341-72C)
- Distillation apparatus, up to 21 of each (refer to figure Attachment 2):
  - Heating mantles
  - mantle stands
  - 250 ml glass boiling flask 24/40
  - glass elbow fitting 24/40
  - glass drip tube 24/40
  - 125 ml Erlenmeyer collection flask 24/40
  - drying tube with desiccant

Safety note

In the event of broken glassware, use only leather gloves to pick up the pieces. The broken pieces may be disposed in a metal can labeled "Sharps."

Steps to distill the silica gel

To distill the samples, perform the following steps:

Step	Action
1	Select the group of samples to be distilled (up to 21 samples).
2	In the laboratory hood, pour the silica gel from each cartridge into a 250 ml boiling flask and place the flask in the mantle.
3	Label (with a permanent ink marker) a cap with the 2-digit station number. Place the sample vial with labeled cap in the holder next to the distillation set-up to identify the sample.
4	Set up the glassware as in the figure in attachment 2 by attaching the elbow tube, drip tubes, desiccant tube, and 125 ml collecting flask.
5	Connect the bank of heating mantles to a variable transformer and set at 80% of the maximum current.

Steps continued on next page.

Processing the silica gel, continued

Step	Action
6	Flip switch on transformer to 120 volts. Heat the silica gel for two hours. **Caution**: The equipment becomes very hot.
7	Allow the mantles and glassware to cool for one hour.
8	Pour the distillate from each flask into its associated vial. Take all these vials to the balance.
9	Empty the used silica gel into plastic containers, and store the cans in the Cave radioactive waste storage area until they are picked up for disposal. Recycle the used metal cans.
10	Thoroughly rinse all distillation glassware. Completely dry all equipment. Repeat steps 1 through 9 for the next group of samples (from the same sampler group).
11	Before weighing vials, use the 5g and the 20g check weights to check the balance function. Put on cloth gloves or use special plastic-tipped tweezers to handle the weights. Enter the results into the appropriate cells on the Access query. Ensure the balance reads zero with no weights.
12	Tare the balance with an empty vial.
13	If not already running, launch the Mettler Toledo BalanceLink program and minimize it to an icon.
14	Use the Access query "Gel Weight Data" and select the proper "user's initials" and "period ID#", then click on "Enter H2O Distilled Weights." Answer "Yes" to warning about updating data.
15	Record the weight of each vial into the Access query. Press F2 to enter the weight from the balance into the proper fields. Repeat for each vial.
16	Print out the just-recorded weight data and re-weigh 6 randomly selected cartridges. Compare the weights with the printout data to verify proper data entry. Record which cartridges were re-weighed and initial and date. File this record as described in the chapter "Records Resulting."
17	Use the query "Gel weight data entry transfer" to transfer the data into the table "Field data ready for V&V."
18	Use the query "Gel weight data entry transfer check" to check the data transfer. • If this query indicates the data transfer was successful, run the delete query "Gel weight data entry zap" to delete the data from the holding table. • If this query indicates the data transfer was NOT successful, contact the AIRNET database administrator or analytical chemistry coordinator.

Steps continued on next page.

Processing the silica gel, continued

Step	Action
19	The 5 trip blanks may be distilled with the townsite or regional groups, but not with the Area G sample group. Record the weights of the vials as was done for the samples.
20	Take 3 pre-prepared lab control samples (sample numbers 91, 92 and 93) from the cabinet.
21	Samples 94, 95 and 96 are matrix spikes and contain known quantities of tritium. Select the three pre-prepared containers (see chapter *Processing H-3 matrix spikes and blanks*) for the sample period.
22	With a permanent marker or pre-printed labels, record the complete sample I.D. on the side. The sample I.D. is a combination of the year, month, day, and station number. **Example**: 000214.32 would represent February 14, 2000, from station number 32. QC samples would be 000214.98 and 000214.99.
23	Assure all container lids are tightly closed, seal each cap with custody tape. Place the containers in a shipping box and wrap with bubble wrap. Label top of box "This side up."

Submitting water samples for analysis

Submitting samples for analysis

After processing the silica gel according to the previous chapter (either loading the silica gel into bottles or distilling the water from the silica gel), prepare either the bottles of silica gel or the vials of distillate for shipment to the analytical laboratory.

Steps to submit samples for analysis

To complete the appropriate paperwork and submit the samples for analysis, perform the following steps:

Step	Action
1	Run AIRNET database and follow the database menus to print the H-3 shipping letter template and H-3 memo template.
2	Save the template file under its new name on the local computer drive. Example: "020318H Shipping.doc".
3	Using the Edit – Replace, replace all "mmdd" with the current date.
4	Using the Edit – Replace, replace all "xxxx" with the month and day of the sample id (e.g., if sample shipment is 020318, replace the x's with 0318).
5	On memo, "Enclosed with this letter are ??", fill in the "??" with the number of samples to be shipped. Double check this number on chain of custody.
6	In Table 1, place "x's" in column "Included in this Shipment" for all samples submitted.
7	Save the file (File - Save) and exit the program (File – Exit)
8	Run Eudora and select Message - New Message. Address to the group secretary and attach the file created above.
9	At group office, pick up completed memo and shipping manifest and shipping information sheet. Be sure signature and initials are obtained. Get a second AIRNET team member to double-check shipping memo, sample ID numbers, dates, and number of samples shipped.
10	Make 3 copies (for MAQ file, chemistry data coordinator and memo's author). Make 2 copies of the chains of custody: one for the validation and verification notebook and one for the tritium chain of custody notebook. Send the original copies of all paperwork with the sample shipment.
11	Take copy of e-mail from buyer that gives shipping approval; or obtain signature of buyer on manifest.
12	Take samples and paperwork to shipping (BUS-4).
13	Return signed shipping manifest to the group office.

Processing H-3 matrix spikes and blanks

Ordering spikes from lab

Approximately every six months or when the current supply of matrix spikes runs low, contact the chemistry organization that supplies the spikes (formerly CST-9) to request about 50 matrix spikes.

Caution for spike samples

If a tritium matrix spike is spilled, call an RCT immediately. Avoid touching the liquid.

Spike samples with concentrations up to 2 μCi/l may be transported without special requirements. If a spike is over this level, use the special transport container with required labeling.

Receiving and labeling spikes

When a new batch of spiked samples is received from the lab, the spiked water must adsorbed onto silica gel and prepped for future sampling periods. Follow the steps below.

Equipment needed

Collect the following equipment and supplies:

- Sealable jars
- Tritiated water spikes
- Deep well water (PM-1 well)
- Small vials (e.g., 20 ml scintillation vials)
- Dried silica gel, 6-12 mesh
- balance, 1000 g capacity (minimum)
- shipping containers

Steps to label new spiked samples and blanks

To process and label the blanks and spikes, perform the following steps:

Step	Action
1	For the blanks, weigh approximately 10 g of deep well water into the small vials.
2	Pour 125 to 145 g of silica gel into each sealable jar.
3	Set the a spiked sample or a blank <u>with lid removed</u> into the a jar, seal the jar, and allow the liquid to be adsorbed into the silica gel. This process will take about a month.
4	Label the shipping containers with the sample identification numbers for upcoming sample periods, with sample numbers 91, 92, 93 (for the blanks) and 94, 95, and 96 (for the spikes).

Steps continued on next page.

Processing H-3 matrix spikes and blanks, continued

Step	Action
5	Pour the silica gel into numbered shipping containers. Be sure to keep the spike vial next to the appropriate shipping container until the numbers are recorded (next step).
6	Have a second person record both the number on the CST spike vial and the sample period ID into the database according to step 7 below as each vial is poured. If a second person is not available, record the data on a sheet for later entry. Leave each spike vial next to the shipping container until step 8 below is completed.
7	In the AIRNET database, open the "Field Data Management" form and select "H-3 Matrix spikes." Highlight the AIRNET period number in the scrolling window and then click the "AIRNET number to CST QC number." Enter the lab's spike number and the corresponding MAQ sample id.
8	To perform the required 100% verification of manually entered data, print out the entered data and have a second person compare the entries in the database with the containers arranged on the work bench.
9	Store the shipping containers in a cabinet in the Cave.

Entering spiked sample values

In the AIRNET database, run the form "Field Data Management" and select "H-3 Matrix spikes", then "Enter new H-3 QC Sample Spike Concentrations." Type in the lab's identifying numbers for each unique spike and the corresponding H-3 concentration.

Next, select the appropriate button on the form to enter the date of preparation of the spikes.

To perform the required 100% verification of manually entered data, print out the entered data and have a second person verify correct entry.

Chain-of-custody for samples

Maintaining custody of samples

A sample is physical evidence collected from a facility or the environment. Chain-of-custody must be documented for all samples used to demonstrate compliance. Verify that the possession and handling of samples is traceable at all times. A sample is considered in custody if it is one of the following:

- In one's physical possession.
- In one's view after being in one's physical possession.
- In one's physical possession and then locked up so that no one can tamper with it.
- Kept in a secure area where access is restricted to authorized and accountable personnel only.

NOTE: A secured area is an area that is locked, such as a room, cooler, vehicle, or refrigerator. If the area cannot be secured by locking, use a custody seal to secure the area or the sample container.

Transferring custody of samples

Whenever samples are transferred into the custody of another person or organization, complete the "relinquished by/received by" and "date" sections of either Attachment 3 or 4 of MAQ-202. These sections of the form must provide a complete history of custody of the samples from collection to transfer to the analytical laboratory.

If chain-of-custody is broken

Whenever there is a break in the chain of custody of a sample, document the failure by initiating a deficiency report in accordance with the procedure for deficiencies (MAQ-026). [The deficiency process will document the occurrence, evaluate the potential impact (if any) on the samples, and propose a corrective action to prevent recurrence.]

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be stored or submitted as described below:

- "Air Monitoring Field Data Form and Chain of Custody Record" (attachment 2 to MAQ-202 or version similar to attachment 3 of MAQ-202 generated according to MAQ-216) – original with samples shipped to analytical lab, one copy in V&V notebook in TA-54 Bldg. 1005, second copy in Cave (backup)
- Printout of silica gel weight data entered into Access "AIRNET" database query, showing verification of data entry –one copy in V&V notebook in TA-54 Bldg. 1005, second copy in Cave (backup)
- letter to analytical laboratory requesting analyses – copy filed by group office when letter is generated
- memo (to BUS-4 and the analytical laboratory) detailing the total activity of the shipment – copy filed by group office when memo is generated
- Shipping Manifest – original with samples shipped to analytical lab, one copy to group office

HAZARD CONTROL PLAN

1. The work to be performed is described in this procedure.
"Sampling of Ambient Airborne Tritium"

2. Describe potential hazards associated with the work (use continuation page if needed).

Thermal burns--skin burns from pumps.
Thermal burns -- ovens, distillation equipment.
Falls/tripping – field hazards.
Animal Injuries -- (snakes, spiders, mountain lions, etc.).
Weather – Lightning.
High Explosives testing (TA-15, TA-16, TA-49).
Radiation Areas (TA-54 Area-G, TA-16).
Electrical shock in wet conditions.
Electrical shock from damaged electrical conduit via vehicle or animal damage.
Cuts/eye injuries from broken glassware.
Silica gel dust inhalation.

3. For each hazard, list the likelihood and severity, and the resulting initial risk level (before any work controls are applied, as determined according to LIR300-00-01, section 7.2)

Thermal burns -- skin burns from pumps--Occassional/Negligible = Minimal
Thermal burns -- ovens, distillation equipment--Improbable/Moderate = Minimal
Falls/tripping – Moderate/Occasional = Minimal
Animal Injuries -- (snakes, spiders, mountain lions, etc.)--Critical/Remote = Minimal
Weather – Lightning -- Catastrophic/Remote = Low
High Explosives testing (TA-15, TA-16, TA-49)--Critical/Remote = Minimal
Radiation Areas (TA-54-Area-G, TA-16) — Negligible/Remote = Minimal
Electrical shock in wet conditions — Catastrophic/Remote = Low
Electrical shock from damaged electrical conduit via vehicle or large animal -- Catastrophic/ Improbable = Medium
Cuts from broken glassware – Occasional/Moderate = Low
Eye Injuries from broken glassware – Improbable/Critical = Low
Silical gel dust inhalation – Improbable/Critical = Low

Overall *initial* risk: ☐ Minimal ☐ Low ☒ Medium ☐ High

4. Applicable Laboratory, facility, or activity operational requirements directly related to the work:
☐ None ☒ List: Work Permits required? ☒ No ☐ List:

National Fire Protection Code -- for use of electrical GFCIs.
LIR 402-600-01.0 "Electrical Safety" for all electrical hazards.

HAZARD CONTROL PLAN, continued

5. Describe how the hazards listed above will be mitigated (e.g., safety equipment, administrative controls, etc.):

Thermal burns -- skin burns from pumps -- Use common sense to avoid these injuries; also covered under "Employee Orientation" training.
Falls/tripping — the "Employee Orientation" includes training and awareness of tripping and falls.
Animal Injuries -- same as above.
Weather (lightning) — same as above.
Entry into High Explosives testing areas --existings controls are stringent and not easily bypassed.
Existing facility controls include site specific training, sign-in/sign-out, and scheduling procedures.
Entry into posted Radiation/Controlled Areas – TA-54-Area-G and TA-15 controls are stringent and not easily bypassed -- Area-G and TA-15 require entry through manned access control gates.
Cuts from broken glassware -- Wear cut resistant gloves.
Eye injuries from breaking glassware – Wear safety glasses.
Silical gel dust inhalation -- Perform all silical gel transfers under a hood.
Thermal burns--ovens, distillation equipment -- Wear heat resistant cloth gloves/observe postings.
Electrical shock in wet conditions -- All stations have GFCIs (ground fault circuit interrupts).
Electrical shock from damaged electrical conduit via vehicle or large animal — the administrative control requires that JCI be contacted to shut power off prior to any further work.

6. Knowledge, skills, abilities, and training necessary to safely perform this work (check one or both):

☒ Group-level orientation (per MAQ-032) and training to this procedure.
☒ Other → See training prerequisites on procedure page 3. Any additional describe here:

7. Any wastes and/or residual materials? (check one) ☐ None ☒ List:

Used silica gel will be stored in rad waste area at Cave until disposed as solid waste.

8. Considering the administrative and engineering controls to be used, the *residual* risk level (as determined according to LIR300-00-01, section 7.3.3) is (check one):

☐ Minimal ☒ Low ☐ Medium (requires approval by Division Director)

9. Emergency actions to take in event of control failures or abnormal operation (check one):

☐ None ☒ List:

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. For any exposed, energized electrical wires, contact JCI or the appropriate authority to turn off the power. Follow all site specific emergency plans for any radiation or explosives emergencies. For dropped spike samples, call an RCT.

Signature of preparer of this HCP: This HCP was prepared by a knowledgeable individual and reviewed in accordance with requirements in LIR 300-00-01 and LIR 300-00-02.

Preparer(s) signature(s)	Name(s) (print) /Position	Date

Signature by group leader on procedure title page signifies authorization to perform work for personnel properly trained to this procedure. This authorization will be renewed annually and documented in MAQ records. Controlled copies are considered authorized. Work will be performed to controlled copies only. This plan and procedure will be revised according to MAQ-022 and distributed according to MAQ-17-030.

FIGURE SHOWING DISTILLATION EQUIPMENT SETUP